REMARKS

Favorable reconsideration of this application is respectfully requested.

Claims 29 and 30 are pending in this application. Claims 29 and 30 were objected to for informalities. Claims 29 and 30 were rejected under 35 U.S.C. § 103(a) as unpatentable over U.S. patent 6,816,552 to Demos in view of U.S. patent 6,295,376 to Nakaya.

Addressing first the objection to claims 29 and 30, each of claims 29 and 30 is amended by the present response as suggested on page 2 of the Office Action.

Addressing now the above-noted prior art rejection based on Demos in view of Nakaya, the claims as written are believed to distinguish over that rejection.

The outstanding rejection cites Demos as the primary reference, but applicants submit Demos does not disclose or suggest the claimed:

> (b) a second mode information for each frame or each set of a plurality of frames, the second mode information indicating (b-1) an average value prediction or (b-2) a linear extrapolation prediction or linear interpolation prediction[.]

Demos describes switching between an average prediction and linear interpolation prediction according to an M value.[1] However, applicants submit the switching between the average prediction and linear interpolation prediction cannot be executed in Demos by the M value in units of a frame or a set of frames without changing a frame structure. That is, in Demos the frame structure will be changed by the M value. As an example, when M=4 with three B frames, the first B frame will use interpolation and the second B frame will use averaging. If the M value is set to "2" so that the first B frame uses averaging, the second B frame will be changed to a P or I frame. Thereby, in Demos the number of encoded bits will increase, and as noted above the frame structure will be changed.

[1] See the cited disclosure in Demos at column 4, lines 13-29.

In contrast to Demos, the claimed inventions can provide switching between an average prediction and linear interpolation prediction and units of a frame or a set of frames without changing a frame structure.

Moreover, in the claimed invention, the first mode information indicates a single prediction referring to a reference frame or a composite prediction referring to a plurality of reference frames, and is encoded for each of macroblocks. Further, the second mode information indicates an average prediction or a linear interpolation/extrapolation prediction, and can be encoded as header data of a frame or header data of a plurality of frames. Those features are clarified in the currently written claims.

In other words, with the claimed invention the single prediction or composition prediction can be set for each macroblock. The average prediction or linear interpolation/extrapolation prediction can be set for every frame or for every plurality of frames. Thereby, the frequency of change between the single prediction and the composite prediction is higher than that of the frequency of change between the average prediction and the linear shape interpolation/extrapolation prediction.

The present inventors recognized the following circumstances.

A prediction precision increases as the frequency of changing the prediction mode increases. A prediction error decreases with an increase in the prediction precision. As a result, the number of encoded bits related to an image decreases. However, the number of encoded bits related to prediction mode information increases as the frequency of changing the prediction mode increases.

In other words, even if the frequency of changing the prediction mode is increased, the encoding efficiency may not be improved. Accordingly, the frequency of changing the prediction mode cannot be determined, as clear to one skilled in the art. Thereby, the

property of a moving image is considered when determining the frequency of changing the prediction mode.

Precision of the composite prediction is higher than that of the single prediction. However, the precision of the single prediction becomes higher than that of the composition prediction when an object hides in a shade of another object (concealment) or when an object appears from a shade of another object (appearance). This results because the object appearing from a shade of another object is seen only on a future frame, and an object that is going to hide in a shade of another object is seen only on a past frame.

An appearance and concealment of an object occur in a frame of a moving image locally. In other words, a frame of a moving image has a region in which the precision of the single prediction is higher than that of the composite prediction and a region in which the precision of the composition prediction is higher than that of the single prediction. When a single prediction or a composite prediction is set for every frame, the single prediction is used in the region for which the composition prediction is suitable, or the composite prediction is used in the region for which the single prediction is suitable, resulting in lowering the prediction precision. As a result, it becomes difficult to improve the efficiency of encoding.

The present inventors recognized the above-discussed environment, and the claimed invention addresses issues as noted above and provides video decoding methods and devices with enhanced efficiency.

In the claimed invention, the single prediction or composite prediction is set for every macroblock. The present inventors experimentally ensured that a decrease of the number of encoded bits due to improvement of prediction precision exceeds an increase of the number of encoded bits due to setting the prediction mode for every macroblock.

In general, precision of the average prediction is higher than that of the linear interpolation/extrapolation prediction. However, there is a case that precision of the linear

interpolation/extrapolation prediction is higher than that of the average prediction, for example in a scene with a fade-in and fade-out in a moving image.

In a scene with a fade-in or fade-out, local time variation of the image can be approximated to a linear change. The linear sum according to a distance between a to-be-encoded image and each of a plurality of reference images provides a preferable approximation.

If a distance between a to-be-encoded image and each of a plurality of reference images is constant, an average prediction can be used.

However, the distance between a to-be-encoded image and each of a plurality of reference images may not be constant. In such a case, the precision of linear interpolation/extrapolation prediction is higher than that of average prediction.

In a scene with a fade-in and fade-out, time-series changes of all regions in a frame are similar to each other. In other words, when a frame has a region in which the precision of linear interpolation/extrapolation prediction is higher than that of average prediction, even in all other regions in the frame, the precision of linear shape interpolation/extrapolation prediction tends to be higher than that of average prediction. In contrast, when a frame has a region in which the precision of average prediction is higher that of linear interpolation/extrapolation, even in all other regions in the frame, the precision of average prediction tends to be higher than that of linear shape interpolation/extrapolation prediction. Accordingly, even if the average prediction or linear interpolation/extrapolation prediction is set for every macroblock, an effect to improve prediction precision cannot be much expected. The efficiency of encoding deteriorates due to an increase of the number of encoded bits.

To address such issues, in the claimed invention, the average prediction or linear interpolation/extrapolation prediction is changed for every frame or every plurality of frames. The present inventors experimentally ensured that a decrease of the number of encoded bits

due to improvement of the prediction precision exceeds an increase of the number of encoded bits due to changing the mode for every frame or every plurality of frames.

In view of the foregoing comments, applicants respectfully submit the claims as written are neither taught nor suggested by Demos in view of Nakaya, and thus claims 29 and 30 are believed to be allowable over that applied art.

As no other issues are pending in this application, it is respectfully submitted that the present application is now in condition for allowance, and it is hereby respectfully requested that this case be passed to issue.

Respectfully submitted,

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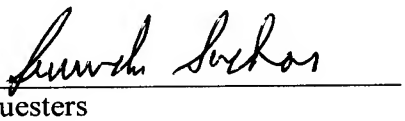

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